



ISSN (E): 2277-7695  
 ISSN (P): 2349-8242  
 NAAS Rating: 5.23  
 TPI 2022; SP-11(11): 2551-2555  
 © 2022 TPI  
[www.thepharmajournal.com](http://www.thepharmajournal.com)  
 Received: 16-08-2022  
 Accepted: 19-09-2022

**Bodiga Divya**  
 College of Forestry, SHUATS,  
 Allahabad, Uttar Pradesh, India

**Sameer Daniel**  
 College of Forestry, SHUATS,  
 Allahabad, Uttar Pradesh, India

**Antony Joseph**  
 College of Forestry, SHUATS,  
 Allahabad, Uttar Pradesh, India

## Adoption pattern of different agroforestry models in Allahabad district of Uttar Pradesh

**Bodiga Divya, Sameer Daniel and Antony Joseph**

### Abstract

A survey was conducted in the villages of the Allahabad district of Uttar Pradesh state with an objective to know the adoption of different agroforestry models by the farmers in the selected region. The main criteria for selecting farmers was the presence of a sufficient agroforestry system, land-holding, reason for agroforestry adoption, constraints faced by farmers, and different socio-economic categories. The results of the survey revealed that among all agroforestry systems Agri-silvicultural system has prominent practice with frequency 190 and percent 76 which stood in 1<sup>st</sup> rank. Adjacent to this Agri-silvi-horticultural system also popular practice which had frequency 170 and 68% ranked as 2. Silvopastoral system had been practiced by least number of respondents which has frequency 161 percent of 64.4. In Agri-silvicultural system, the highest frequency, percent was recorded under eucalyptus+mustard mix of Agri-silviculture gained 1<sup>st</sup> rank among all other crops combinations followed by teak+paddy and eucalyptus+ wheat amalgamated Agri-silvi combination with frequency 239 and percent 95.6%. In Agri-horticultural system the highest number of farmers were practiced citrus+wheat combination of Agri-horticultural with 96.8% and 242 frequency as 1<sup>st</sup> rank. The larger level of adaptation was under neem+guava+mustard with 240 frequency and 96% (1<sup>st</sup> position) was observed in Agri-silvi-horticultural System, where Agri-silvi-pastoral system of agroforestry was found with has greater frequency of teak+mustard+berseem adaptation as 237 and 94.8% among all the respondents. The lowest adoption by the farmers was observed as Eucalyptus + Wheat, Mango+ pigeonpea, teak +rose, Poplar+wheat+berseemin respective agroforestry systems.

**Keywords:** Adoption, agroforestry, socio-economic, frequency

### 1. Introduction

Agroforestry is a dynamic, ecologically oriented strategy for managing natural resources that integrates trees and other woody perennials into farms and rangelands to diversify output and maintain it for greater social, economic, and environmental advantages (Handa *et al.*, 2016) [5]. By providing habitat for native pollinators, which are connected to agricultural yield, this application can enhance the total variety of plants and the physical landscape structure. The agricultural technique which is named as agroforestry enhances socioeconomic conditions while also providing both protective and productive advantages. (Nair *et al.*, 1990, 1993) [15, 16].

According to (ICRAF, 2004) [6], agroforestry is a practice where woody perennials are deliberately grown on the same land management unit with agricultural crops and/or animals in the same form of spatial mixture or in temporal sequence". In order to increase productivity, profitability, variety, and the sustainability of ecosystems, agroforestry is described as a mix of land-use systems that incorporates trees and shrubs on farmlands and rural landscapes, whether or not they have animals (National Agroforestry Policy, 2014) [17].

There are various forms of agroforestry, such as (a) Agri-silvicultural, in which trees and agricultural crops are grown together, (b) Silvi-pastoral, in which trees are raised on pastures or alongside fodder crops, and (c) Agri-silvi-horticultural, in which silviculture trees, horticulture crops, and agricultural combinations are managed on the same piece of land. Scientists Mughal and Bhattacharya (2002) [12], Kumar (2017) [10], Dwivedi (2007) [3], Tewari (2008) [20], Karemulla (2007) [9], and Singh (2009) [19] have also developed other kinds such as Silvi-horticultural system and Agri-Silvi-horticultural system.

Uttar Pradesh is the India's most significant agricultural state, which has more than 21 million farm holdings in addition to having the biggest cultivated area of 25,785 thousand hectares. The nation's top producer of food grains is Uttar Pradesh. In Uttar Pradesh's Eastern Plain, agroforestry is still in its infancy.

**Corresponding Author:**  
**Bodiga Divya**  
 College of Forestry, SHUATS,  
 Allahabad, Uttar Pradesh, India

In Uttar Pradesh, several agroforestry techniques are used depending on the agro-climatic zone, the available land, and the socioeconomic status of the farmer. The variability is reflected in the diversity of agroforestry systems, and comparative advantage has reignited interest in realizing the dynamic potential (Verma *et al.*, 2017) <sup>[13]</sup>. According to the 2019 Forest Survey of India report, trees and other forms of forest cover make up 3.05% of the 7342 sq km that make up Uttar Pradesh. Eastern Plains and North Eastern Tarai zones of the state should adopt appropriate agroforestry systems, such as agri-silviculture, silvi-horticulture, agri-silvi-horticulture, and silvo-pastoral systems, in place of monocropping. Hence deeper idea on farmer's land holdings, different socio-economic conditions and adoption of different agroforestry systems and constraints faced by farmers in different regions is needed for implementing the adoption of different Agroforestry systems in large scale.

Therefore, keeping all the above facts in mind, a study was undertaken with an objective of adoption of different agroforestry models in Allahabad district of Uttar Pradesh.

## 2. Material and Methods

### 2.1 Location of the study area

Allahabad is also known as Prayagraj is among the largest cities of Uttar Pradesh and situated at 25° 27'N 81° 51' E / 25.45, 81.85 the confluence of three rivers – Ganga, Yamuna and the invisible Saraswati. The elevated area of 305km<sup>2</sup> with population 1,395,816. Selected villages for the study namely, Champatpur, Sonai Kapura, Mohabatganj Uparhar, Bhandra Umar Ganj and Dandpur.

### 2.2 Selection of Farmers and Respondents

Farmers were selected based on the objective of the research on agroforestry systems and intensive farming systems used by farmers. Farmers selected in the area were widely distributed using a various cropping system. The main criteria for selecting farmers are the presence of a sufficient agroforestry system, land-holding, reason for agroforestry adoption, constraints faced by farmers, and different socio-economic categories. Multi-stage sampling was employed to gather all the information. 50 respondents from each sample village were selected at random to participate in the comprehensive survey. 250 respondents in all responded to the survey.

### 2.3 Methodology of data collection

Basic demographic information was meant to be gathered by a simple questionnaire survey that was semi-structured and used to obtain primary data. The majority of these farmers were engaged in agroforestry on their land. The questionnaires were made to gather data on the farmers' adoption of and use of current agroforestry methods as well as various insect occurrences during crop cultivation. Numerous Focus Group Discussions (FGD) at the farmer level include local farmers in debate on agroforestry practices and how they

are fending off insect assault in agroforestry by using the following strategies. These were conducted in order to understand about the opinions and concerns that farmers had about agroforestry operations. The amount to which respondents believe a certain question has been answered is elicited from them. First, depending on the respondents' replies, the effect of various questions is recorded as yes, no, extremely high, high, moderate, low, indifferent, or adverse, and so on. The questionnaires were adjusted as necessary, and a survey was carried out in the study area. Questions were developed based on the survey requirements of each objective, using determinants previously mentioned by Abdrabo and Hassan (2003) <sup>[11]</sup>, Kumar *et al.* (2004) <sup>[9]</sup>, Dwivedi *et al.* (2007) <sup>[3]</sup>, Mughal *et al.* (2000) <sup>[12]</sup>, and Karemulla *et al.* (2005) <sup>[8]</sup>. Utilizing primary and secondary sources, the methodology was utilised to collect quantitative and qualitative data. A home survey with all different sorts of farmers was the main strategy for gathering primary data. Observation, interview-discussion, group discussions, and, when practical, key informant interviews were the primary methods used to gather quantitative data; field trips and questionnaire administration were used to gather qualitative data. Integrating two data collection approaches, as Patton *et al.* (2002) <sup>[18]</sup> suggested, increases variability since one method makes up for the shortcomings of the other. Secondary information has been gathered from various sources and used as necessary.

## 3. Results and Discussion

### 3.1 Adaptation and Non Adaptation of Agroforestry systems in Allahabad district of Uttar Pradesh

During surveys conducted in the study area, it was found that majority of farmers were practicing different agroforestry practices. (Adnan Jamilu *et al.*, 2014) <sup>[2]</sup>. The major forms of agroforestry in the area have been classified based on their frequency and percent of farmers adaptation, similarly frequency and percentage of non adaptation. In this study more emphasis was on different agroforestry practices type of components and arrangement of such components.

The results of the survey on different agroforestry models adopters and Non- adopters in Allahabad district were expressed in table. 1 As table 1 and Fig. 1 has shown that across the respondents of Allahabad district of Uttar Pradesh different kinds of agroforestry models had different level of adaptation due to various reasons. Among all agroforestry systems Agri-silvicultural system has prominent practice with frequency 190 and percent 76 which stood in 1<sup>st</sup> rank. Adjacent to this Agri-silvi-horticultural system also popular practice which had frequency 170 and 68% ranked as 2. Silvopastoral system had been practiced by least number of respondents which has frequency 161 percent of 64.4. In non-adopters it considered as highest under Agri Silvi Horti system with frequency 80 and 32%. As per (Philip K Mukungei *et al.*, 2013) <sup>[14]</sup> as suggested that the adaptation on different Agroforestry system by the different farmers.

**Table 1:** Different agroforestry models adopters and Non- adopters in Allahabad district (N=250)

Agroforestry practices	Adopters			Non adopters		
	Frequency	Percentage	Ranking	Frequency	Percentage	Ranking
Agrisilvicultural system	190	76	1	60	24	4
Agri Silvi Horti system	170	68	2	80	32	1
Silvopastoral system	161	64.4	4	70	28	3
Other systems	168	67.2	3	82	32.8	2

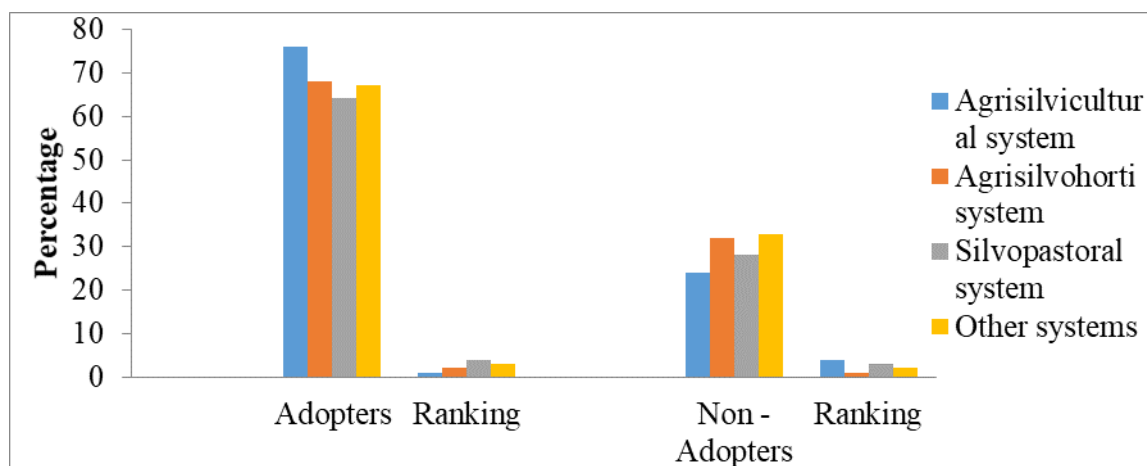


Fig 1: Different agroforestry models adopters and Non- adopters in Allahabad district

### 3.2 Different agroforestry Practices followed by Respondents in the District

Data presented below to know farmers' preference on adopted agroforestry practice types in their field. On basis of practice counts, total 250 respondents were surveyed as derived from questionnaires. Based on responses received from sample farmers' different types of agroforestry practices were reported which have been mentioned. Different combinations of these practices have been depicted as various agroforestry models.

#### 3.2.1 Agri-silvicultural system

Agri-silvicultural crops ie., combination of agroforestry system in Allahabad district were expressed in the table 2 and Fig. 2. The results revealed that the highest frequency, percent was recorded under eucalyptus+ mustard mix of Agri-silviculture gained 1<sup>st</sup> rank among all other crops combinations followed by teak+ paddy and eucalyptus+ wheat amalgamated Agri-silvi combination with frequency 239 and percent 95.6%. The least response of adaptation was by teak+wheat combined Agri-silvicultural system with 5<sup>th</sup> rank.

Table 2: Agri-silvicultural system followed in Allahabad district

Agri-silvicultural system	Frequency	Percent	Rank	Total
Teak+ Paddy	239	95.6	2	250
Teak+ Mustard	237	94.8	4	250
Teak+wheat	234	93.6	5	250
Eucalyptus +Paddy	238	95.2	3	250
Eucalyptus + Mustard	240	96	1	250
Eucalyptus + Wheat	239	95.6	2	250

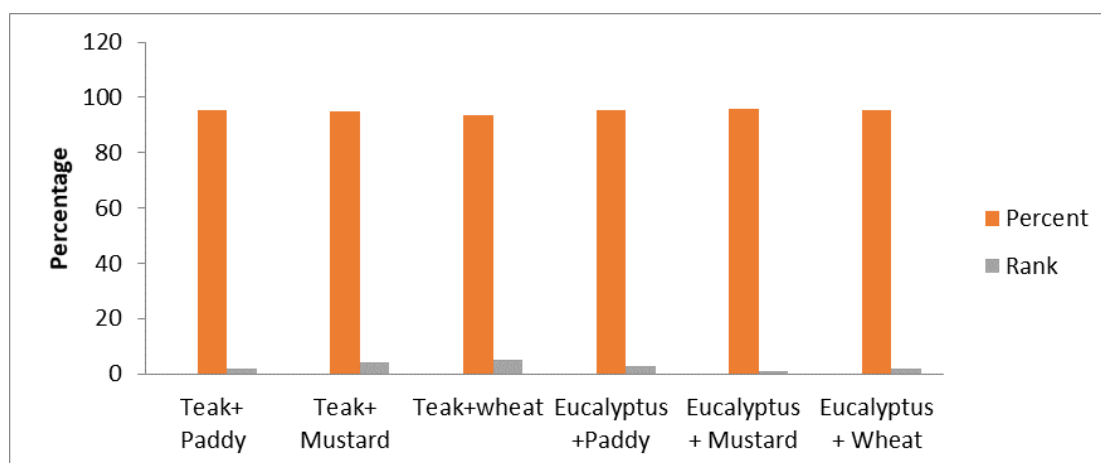


Fig 2: Agri-silvicultural system followed in Allahabad district

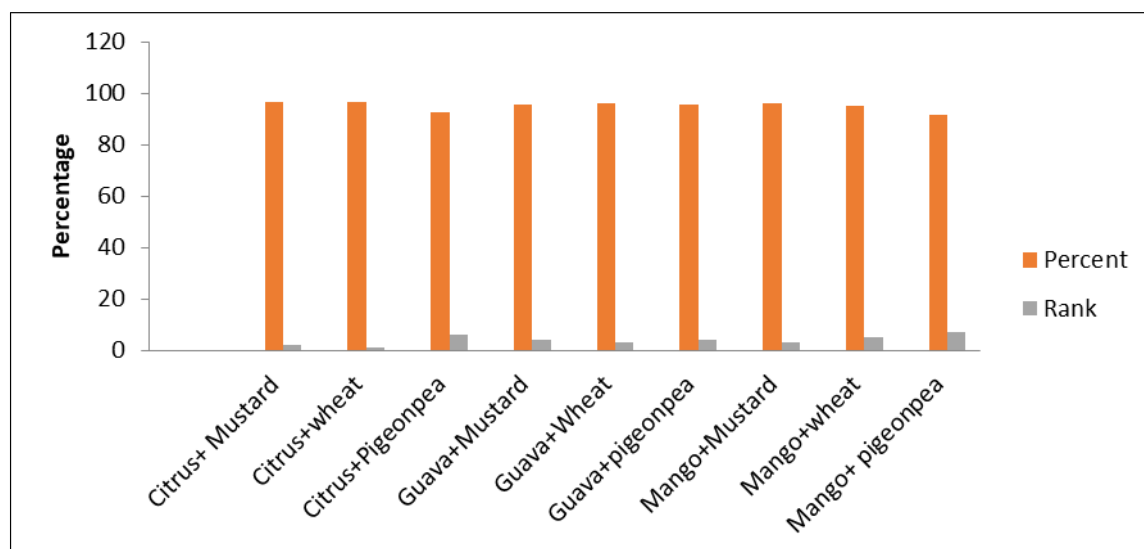
#### 3.2.2 Agri-horticultural system

The survey results of the Agri-horticultural system in the study area were presented in table. 3 and Fig. 3. As per the results it can be concluded that highest number of farmers were practiced citrus+wheat combination of Agri-horticultural with 96.8% and 242 frequency as 1<sup>st</sup> rank. Followed by citrus+ mustard united method of Agri-horticultural which has

241 frequency and 96.4%. Later two (guava+wheat, mango+mustard) combinations were stood in 3<sup>rd</sup> position of cultivation. Among all the crop combinations mango+ pigeonpea combination was least number of farmers were practiced which has 239 frequency and 7<sup>th</sup> rank. (Montes *et al.*, 2019)<sup>[11]</sup> had studied based on this system and revealed it has greater importance's to the farmers.

**Table 3:** Agri-horticultural systems in Allahabad district

Agri-horticultural system	Frequency	Percent	Rank	Total
Citrus+ Mustard	241	96.4	2	250
Citrus+wheat	242	96.8	1	250
Citrus+Pigeonpea	232	92.8	6	250
Guava+Mustard	239	95.6	4	250
Guava+Wheat	240	96	3	250
Guava+pigeonpea	239	95.6	4	250
Mango+Mustard	243	96	3	250
Mango+wheat	238	95.2	5	250
Mango+ pigeonpea	239	91.6	7	250

**Fig 3:** Agri-horticultural systems in Allahabad district

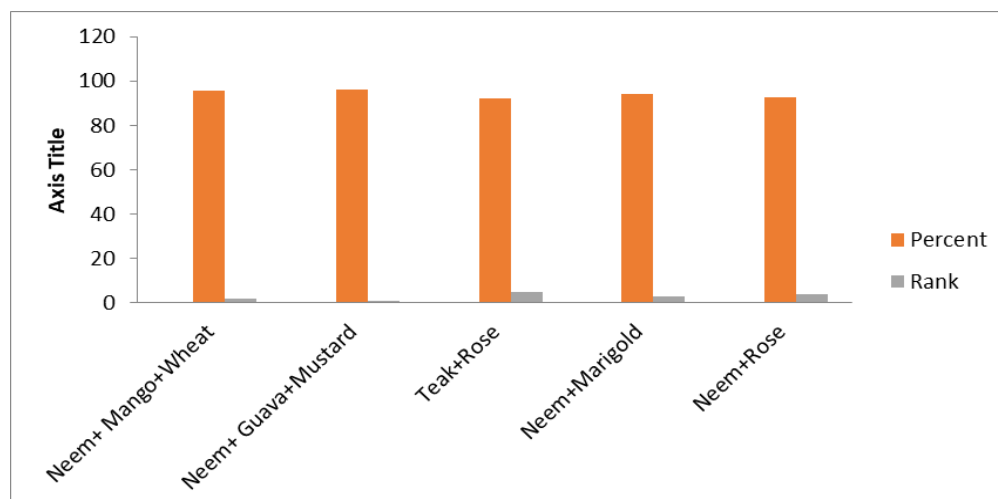
### 3.2.3 Agri-silvi-horticultural System

The survey results of Agri-silvi-horticultural system of Agroforestry with crop combinations were expressed in table 4 and Fig. 4. The results revealed that the larger level of adaptation was under neem+guava+mustard with 240

frequency and 96% which was in 1<sup>st</sup> position. Followed by this neem+mango+wheat gaining second position. Similarly, teak +rose was at lower percent of adaptation with 230 frequency and 92% of 5<sup>th</sup> rank.

**Table 4:** Agri-silvi-horticultural system followed in Allahabad district

Agri-silvi-horticultural Syetem	Frequency	Percent	Rank	Total
Neem+ Mango+Wheat	239	95.6	2	250
Neem+ Guava+Mustard	240	96	1	250
Teak+Rose	230	92	5	250
Neem+Marigold	235	94	3	250
Neem+Rose	231	92.4	4	250

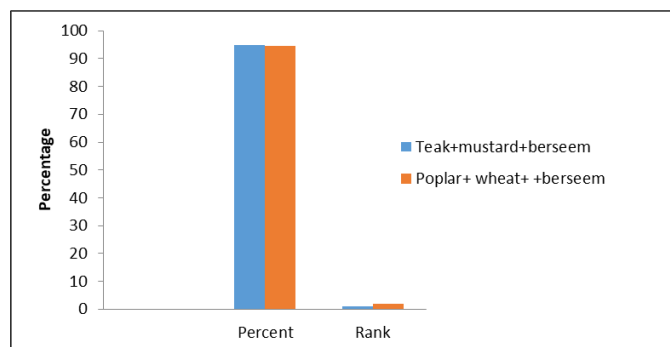
**Fig 4:** Agri-silvi-horticultural system followed in Allahabad district

### 3.2.4 Agri-silvi-pastoral system

The results of farmer's adoption of different Agri-silvi-pastoral system in study area were represented in the table 5 and Fig. 5. As per the table it was found that Agri-silvi-pastoral system of agroforestry with teak+mustard+berseem has greater frequency of adaptation as 237 and 94.8% among all the respondents of Allahabad district. Poplar+wheat+berseem lies in second position with 94.4% of practiced by respondents of Allahabad.

**Table 5:** Agri-silvi-pastoral system followed in Allahabad district

Agrosilvopastoral system	Frequency	Percent	Rank	Total
Teak+mustard+berseem	237	94.8	1	250
Poplar+ wheat+ +berseem	236	94.4	2	250



**Fig 5:** Agri-silvi-pastoral system followed in Allahabad district

### 4. Conclusion

Cultivating Agricultural, horticultural crops in combination with trees, fodder is a land use management that farmers have been practicing from ages. With this study it was found that majority of farmers were practicing agroforestry in the study area. In Allahabad district among all agroforestry models Agri-silvicultural system was being practiced by majority of the respondents. Agri-silvihorti system was also adopted slightly less than Agri-silvicultural system of agroforestry. Agri-silvi-pastoral system was adopted by minimal number of respondents. Practicing Agroforestry being as viable, remunerative and sustainable income for the farmers of the districts.

### 5. References

- Abdrabo MA, Hassaan MA. From river catchment to the sea: comparative and integrated approach to the ecology of Mediterranean coastal zones for sustainable management (MEDCORE). A manual for socio-economic study. Centre for environment and development for the Arab region and Europe, EC (CADARE); c2003. p. 76.
- Adnan Jamilu, Haider Ammar, Danish Munir Gardish. Factors upsetting agroforestry system in Swat, Pakistan, Department of Social Forestry and Forest Governance, College of Forestry and Natural Resources, National University of Sciences and Technology, Rawalpindi, Islamabad, Karachi, Risalpur, Pakistan, Research Paper published in International Journal of Agroforestry and Silviculture. 2014;1(8):086-092.
- Dwivedi AP. Agroforestry principle and practices. Oxford & IBH publishing company, New Delhi, India; c2007.
- Dwivedi AP. Agroforestry principle and practices. Oxford & IBH publishing company, New Delhi, India; c2009.
- Handa AK, Toky OP, Dhyani SK, Chavan S. Innovative agroforestry for livelihood security in India. world agriculture; c2016. p.16.
- ICRAF. Approved definition of use and adoption. Harare, Zimbabwe. ICRAF, Southern Africa. International e-Journal. 2004-2015;4(2):163-170.
- Karemulla K. Economic analysis of agroforestry systems methods and illustrations, In Agroforestry: Natural resource sustainability, livelihood and climate moderation (Chaturvedi O.P. and Venkatesh, A. (eds.) Satish Serial Publishing House, Delhi; c2009. p. 639-659.
- Karemulla K, Rizwi RH, Kumar K, Dwivedi RP, Singh R. Poplar agroforestry systems in Western Uttar Pradesh: A Socio-economic analysis. Forests, Trees and Livelihoods. 2005;15(4):375-382.
- Kumar R, Gupta PK, Gulati A. Viable agroforestry models and their economics in Yamuna Nagar district of Haryana and Haridwar district of Uttaranchal. Indian Forester. 2004;130(2):131-138.
- Kumar Y, Thakur TK, Thakur A. Socio-cultural paradigm of Agroforestry in India. Int. J Curr. Microbiol. App. Sci. 2017;6(6):1371-1377.
- Montes O, Castro R, Villanueva C, Pérez M, Uribe M. Tree used in horticulture based alley cropping. Journal of Applied Horticulture, 2019, 21(2).
- Mughal AH, Bhattacharya P. Agroforestry systems practiced in Kashmir Valley of Jammu and Kashmir. Indian Forester. 2002;128(8):212-226.
- Verma P, Bijalwan A, Dobriyal MJR, Swami SL, Thakur TK. A paradigm shift in agroforestry practices in Uttar Pradesh. Current Science. 2017;112(3):509-515.
- Mukungei PK, Cheserek GJ, Arusei EJ, Chedotum K, Mining PJ. Socio-economic factors affecting farmers' decisions to adopt agro-silviculture in Turbo Division, Uasin Gishu County, Kenya. Journal of emerging trends in economics and management sciences. 2013;4(1):8-14.
- Nair PKR. Classification of agroforestry systems, In Mac Dicken, K. G. and Vergana, N. T. (eds.) Agroforestry: Classification and Management. John Wiley, New York, NY; c1990. p. 31-57
- Nair PKR. An Introduction to Agroforestry. Kluwer Academic Publishers, Dordrecht, The Netherlands; c1993. p. 489.
- National Agroforestry Policy. Government of India, Department of Agriculture and Cooperation, Ministry of Agriculture New Delhi; 2014. p. 13.
- Patton MQ. Qualitative research and evaluation methods (3rd ed.), SAGE Publications, Thousand Oaks, California; 2002. p. 598.
- Singh DK, Singh AK., Yadav VP, Singh RB, Baghel RS, Singh M. Association of socio-economic status with economic motivation of the farmers. Indian Research Journal of Extension Education. 2009;9(2):53-56.
- Tewari SK. Farm forestry: agroforestry. Agroforestry project. G.B. Pant University of agriculture and technology, Pantnagar, India; c2008. p. 05